

## Summary report

# Outputs, outcomes and emerging impacts

Results from HRB funded awards that completed in 2018-19



## **Acknowledgements**

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## **Disclaimer**

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## Table of Contents

1	Introduction .....	5
2	Some key figures .....	7
2.1	Number, type, and value of awards .....	8
2.2	Achievement of objectives .....	9
2.3	Knowledge creation .....	9
2.4	Capacity-building and Leadership .....	12
2.5	Collaborations and leveraged funding .....	14
2.6	Informing policy and practice.....	17
2.7	Non-academic engagement activities .....	18
2.8	New research tools, materials, and methods .....	19
2.9	Healthcare innovations .....	21
2.10	Commercialisation and economic benefit .....	22
2.11	Data usage.....	24
Appendix A	Impact Assessment (“Payback Framework”) .....	25
Appendix B	Summary of key indicators from awards ending in 2018–19, by award type .....	27
Appendix C	Summary of key indicators from awards ending 2018–19, by broad research area .....	29

## List of Figures

Figure 1: Distribution of awards, per broad research area and award type, 2018-19.....	8
Figure 2: Percentage of awards achieving all their objectives from 2008-19 .....	9
Figure 3: Number of publications in open access journals and open publication platforms, 2018-19.....	10
Figure 4: Breakdown of total number of posts created, per broad research area, 2018-19 .....	12
Figure 5: Number of research prizes, research prizes, and recognition reported by HRB award holders, per type, 2018-19 .....	13
Figure 6: Map of collaborators established by HRB awards-holders, 2018-19 .....	15
Figure 7: Types of policy and practice outputs, per broad research area, 2018-19 .....	17
Figure 8: Purpose of PPI activities undertaken by HRB award holders, 2018-19.....	19
Figure 9: Breakdown of new tools, materials, or methods, per broad research area, 2018-19.....	20
Figure 10: Number of healthcare innovations, per innovation type and broad research area, 2018-19 .....	21
Figure 11: Distribution of commercialisation outputs, 2018-19 .....	23

## List of Tables

Table 1: Summary of scientific dissemination outputs, 2018–19, compared to previous reporting periods.....	8
Table 2: Other scientific publications, 2018-19 .....	9
Table 3: Summary of capacity building outputs, 2018–19, compared to previous reporting periods .....	10
Table 4: Summary of research collaboration and partnership outputs, 2018–19, compared to previous reporting periods .....	12
Table 5: Number and value of awards leveraged by HRB award holders, 2018–19 .....	14
Table 6: Summary of policy and practice outputs, 2018–19, compared to previous reporting periods .....	15

Table 7: Summary of non-academic engagement and PPI outputs, 2018–19, compared to previous reporting periods .....16

Table 8: Summary of research tools, materials, and methods outputs, 2018–19, compared to previous reporting periods .....18

Table 9: Summary of healthcare innovations in the 2018–19 reporting period, compared to previous reporting periods .....19

Table 10: Summary of commercialisation activity, 2018–19, compared to previous reporting period .....25

Table 11: 'Payback Framework' impact categories and indicators (based on Buxton and Hanney).....23

Table 12: Summary of key payback indicators from awards ending in 2018–19, per award type .....25

Table 13: Summary of key payback indicators from awards ending in 2008-19, per broad research area.....27

## 1 Introduction

This report presents a snapshot of the outputs, outcomes, and some emerging impacts arising from 170 Health Research Board (HRB) awards (with a combined value of €49.5 million) that completed in 2018 and 2019. Further outputs, outcomes, and impacts can be expected to occur in the years following the completion of these awards. The reported awards spanned two different strategies at the HRB with 48% of awards granted between 2011 and 2015, within the remit of the HRB Strategic Business Plan 2010-2015, and 52% of awards granted between 2016 and 2018, under the HRB Strategic Business Plan 2016-2020.

The outputs and outcomes reported in 2018 and 2019, combined with those from past reporting periods, provide 12 years of evaluation data from completed HRB awards and, where possible, trend analysis of these data is provided.

In order to understand how well HRB award holders are doing in comparison to their peers internationally, the United Kingdom's Medical Research Council (MRC) *10 years of outcomes reported by MRC projects* [1], which collects similar metrics, is used as a comparator for the data contained in this report.

The purpose of this report is to understand whether the award schemes in which the HRB invests are meeting their scientific objectives and are productive across a range of evaluation metrics. This can provide evidence to inform the HRB's funding strategy and decisions relating to new or existing funding initiatives. It is also important that the HRB is transparent about the outputs, outcomes, and emerging impacts from its research investments. The value of the HRB's current funding commitment is in the region of €245 million. As this is public money, there is an onus on the HRB to account to Government and other stakeholders, including the public, for the funds it allocates and the returns on this investment.

HRB evaluation data collection is guided by the Buxton and Hanney Payback Framework, for health research (Buxton and Hanney, 1994, 1996, 1997; Donovan and Hanney, 2011 [2-5]), originally developed to examine the 'payback' of health services research. This framework groups evaluation metrics into five payback categories that span short- to medium-term outputs and outcomes (knowledge production, research capacity building, informing policy and the public) and longer-term impacts effected through policy and clinical practice changes, health sector innovations, and economic and commercial activity. The full HRB framework, adapted from Wooding *et al.* (2004) [6], is presented in Appendix A

An important caveat in considering the findings in this report is that the analysis presented is not a complete picture of all outputs and outcomes of HRB-funded research. There can be a considerable time lag (>5 years) before research outputs manifest in outcomes and their ultimate impacts on society and the economy become clear, depending on the research area in question. Therefore, evaluation data collected at the point of end of grant (EOG) can only provide a snapshot in time. Further outputs, outcomes, and impacts would be expected to occur in the years following the completion of an award.

The data described in this report demonstrates a wide variety of outputs produced by HRB-funded research in terms of knowledge production, capacity-building, policy and practice outputs, health sector innovations and enterprise outputs.

The trends observed since 2010 and reported here demonstrate the impact of strategic and policy decisions that the HRB has taken over this time period. These strategic and policy decisions include the following:

- Shifting investment away from Basic Biomedical Research to focus on enhancing activity in patient-oriented research, Population Health Sciences, and Health Services Research has resulted in significant increases in the productivity of awards in these areas, particularly in the knowledge creation, capacity enhancement, and informing policy and clinical practice Payback categories. For example, the share of publications by awards in the broad research area of Health Services Research tripled since 2016–17, and the combination of Health Services Research and Population Health Sciences posts accounted for more than one-half of all positions supported for the first time in 2018–19.
- The impact of the HRB’s strategic objective to generate relevant knowledge and promote its application in policy and practice is evidenced by a significant increase in reported engagement outputs with policy-makers, healthcare providers and decision-makers, patient groups, and the public.
- Investing in infrastructure and research leaders in order to facilitate high-quality clinical research and designing schemes to attract both academic and health and social care professionals has paid dividends. For example, the 2018–19 reporting period saw the highest average number of healthcare innovations per award.
- The HRB’s continuing emphasis on a multidisciplinary collaborative funding model has resulted in HRB award holders reporting collaborations with partners in 20 countries and significant Irish research collaborations with academics, policy-makers, healthcare providers, and decision-makers.
- Driving the policy changes and infrastructure required in order to support open access publication of HRB-funded publications resulted in open access publications accounting for 85% of all peer-reviewed publications in 2018–19; 37% of these were published on HRB Open Research.
- Taking a lead nationally in promoting the incorporation of public and patient involvement (PPI) in the research that HRB funds led to the 2018–19 reporting period seeing the highest level of PPI to date, with a growing understanding of what PPI requires and increasing numbers of award holders including meaningful engagement with the public, patients, and carers at all stages of their research.
- The importance that the HRB places on international peer review and methodological rigour in order to ensure that only high-quality research is funded is reflected in the observed upward trend since 2010 across the full range of Payback Categories, with increases in many metrics compared to previous reporting periods. It is also reflected in the success of HRB award holders in leveraging their HRB-supported research to win more than €100 million in additional funding from a wide variety of exchequer and non-exchequer sources both nationally and internationally.

For the first time, this report examined the level of data usage by HRB award holders, including their level of data deposition and sharing, and their use of secondary analysis of data in their research, and linkage of datasets, as well as the impediments they have experienced in carrying out these activities. The number of award holders reporting any of these activities was modest but is expected to grow in future reporting periods as the emphasis on data sharing becomes more embedded into HRB schemes and the skills, knowledge, and awareness of researchers in this sphere increases.

## 2 Some key figures

In total  
**170**  
 awards  
 worth (€ million)  
**€49.5m**

### Scientific Knowledge

- 792 peer review publications
- 1,560 presentations at national and international conferences
- 158 keynote or international invited speaker addresses
- 396 scientific collaborations (9% with health bodies)
- 85% papers open access
- €100M leveraged (€2.02 per euro HRB funding)
- 77 awards had 575 PPI outputs
- 396 academic collaborations, partners or networks



### Research Capacity and Leadership

**451**   
 new jobs created

- 176 health professionals – research informed care
- 103 PhDs and 136 post docs – 29 PhDs were health and care professionals

**54%**   
 of posts in Population Health Sciences and Health Services Research

**51**   
 (11%) people moved to private sector

**44%**   
 of awards reported 324 awards and recognition

### Policy, practice and health benefits

**190**  
 policy and practice influences, of which:

- 116 presented findings to stakeholders or influenced training
- 25 submitted evidence to or served on policy committee
- 20 published policy reports or treatment guidelines
- 14 cited in clinical guidelines or reviews
- 473 engagements with key stakeholders (non-academic) workshops, open days, talks and presentations
- 37 secondary data analysis outputs



### Innovation, commercialisation and enterprise benefits



**116** novel research tools, materials or methods – assays, biobanks & cell lines, data handling/ analysis or education materials



**57** health sector innovations – clinical decision support tools, care models, therapies, diagnostic tools or information videos



**28** commercial or economic benefits including patents, copyrights, licencing agreements and start-ups.



**46** industry collaborations

### 2.1 Number, type, and value of awards

In order to achieve outputs and outcomes of benefit to health and well-being, the HRB supports Projects and Programmes, Infrastructure and Networks, and Capacity Building and Leadership Enhancement awards across a broad spectrum of research areas relevant to health. This chapter examines these inputs and their distribution across different funding mechanisms, broad research areas, and host institutions.

#### Key Findings

- The 170 HRB awards that reported on evaluation metrics in 2018–19, with a combined value of €49.5 million, represented 95.5% coverage of all HRB awards that completed in this reporting period.
- The HRB awards reported on spanned two different strategies: 48% of awards granted between 2011 and 2015 fell within the remit of the *HRB Strategic Business Plan 2010-2014* [7], and 52% of awards granted between 2016 and 2018 fell under the *HRB Strategic Business Plan 2016-2020* [8].
- Projects and Programmes awards accounted for 75% of all HRB awards and 65% of total funding; Capacity Building and Leadership Enhancement awards accounted for 24% of all HRB awards and 34% of total funding; and Infrastructure and Networks awards accounted for 1% of all HRB awards and 2% of total funding.
- Spend on Basic Biomedical Research has been in steady decline since 2008, with no HRB investment recorded in either the 2016–17 or 2018–19 reporting periods. Spend on awards categorised as Clinical Research has risen sharply since 2008, and trend analysis shows that this pattern has remained relatively stable since 2014–15. Applied Biomedical Research remained relatively constant from 2008–09 to 2014–15 but decreased in the two most recent reporting periods of 2016–17 and 2018–19.
- Investment in Health Services Research has increased since 2016–17, and Population Health Sciences investment has remained stable compared to 2016–17.
- Trinity College Dublin; University College Cork; the National University of Ireland, Galway; and the Royal College of Surgeons in Ireland, respectively, held the highest proportion of HRB awards by value in 2018–19. This same order of awards was also reported in 2016–17.

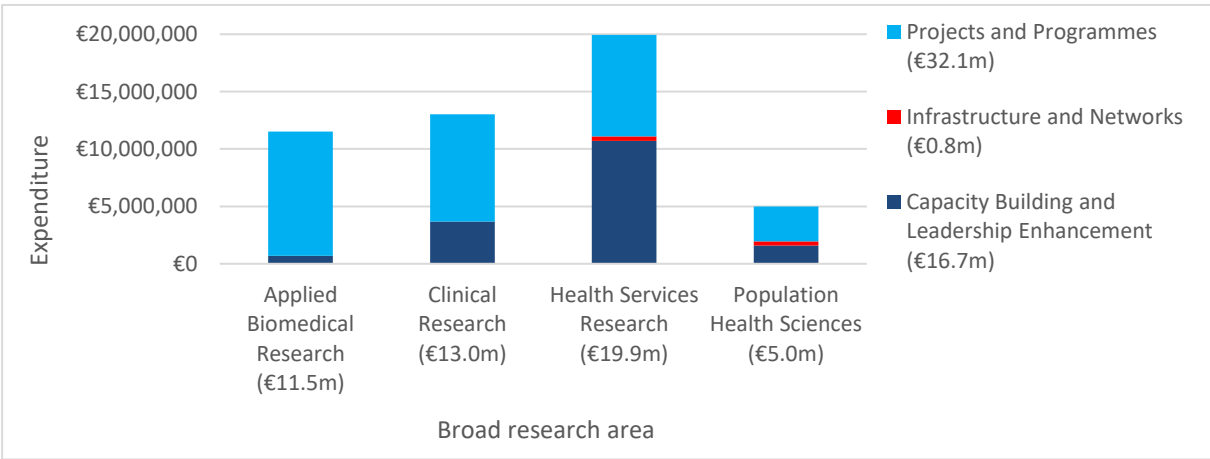


Figure 1: Distribution of awards, per broad research area and award type, 2018-19

## 2.2 Achievement of objectives

In their original grant application, award holders outlined the specific research objectives that they sought to achieve with their HRB funding. At the completion of their awards, award holders were asked to indicate the extent to which these objectives were fulfilled during the period of the award. The purpose of this question was not punitive, but rather to learn about the impediments that HRB award holders experience in carrying out their research. This chapter examines the responses to that question.

### Key Findings

- There has been a steady increase in the number of objectives reported as fully achieved by the award holders, from 43% in 2008–09 to 73% in 2018–19.
- Award holders reported that 21% of their original research objectives were only partially achieved. The most common reasons cited for partial achievement were: underestimating the time required or aspects of the research taking longer than originally anticipated (37%, n=59); early findings in the research leading to a shift in research focus (18%, n=28); and technical problems, or lack of access to essential equipment or infrastructure (15%, n=24).
- Award holders reported that 4% of their original research objectives were not achieved at all. The most common reasons cited for not achieving the original research objectives were: early findings in the research leading to a shift in research focus (25%, n=7); research objectives changing due to developments in the external environment/society (25%, n=7); and underestimating the time required or aspects of the research taking longer than originally anticipated (14%, n=4). COVID-19-related delays were also cited by 14% of award holders (n=4).

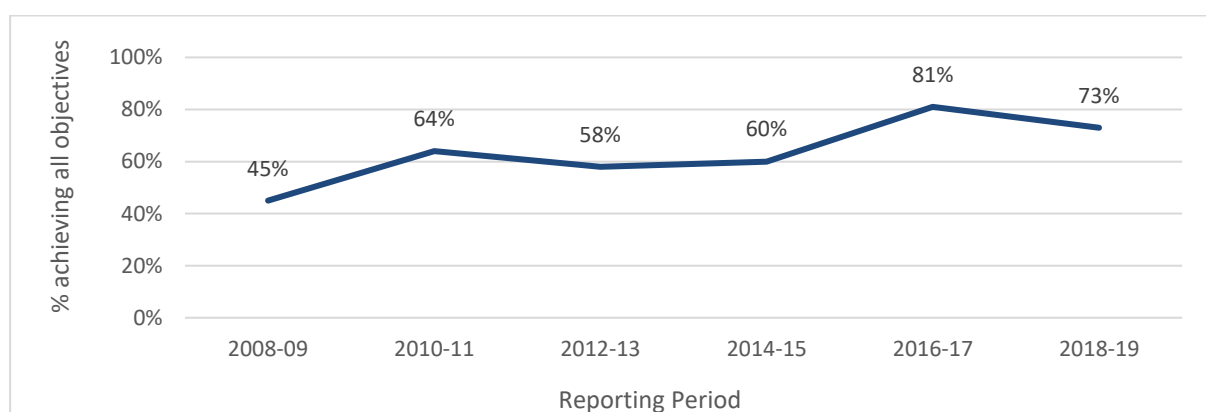


Figure 2: Percentage of awards achieving all their objectives from 2008-19

## 2.3 Knowledge creation

Scientific dissemination is at the core of the research process. It enables award holders to build on existing scientific knowledge and to develop collaborations with colleagues both nationally and internationally in order to advance specific areas of research. Important indicators of scientific dissemination activity include:

- Publication of peer-reviewed papers in scientific journals that have a wide readership and scientific credibility,

- Oral presentations and the presentation of scientific posters to peers at national and international scientific conferences, and
- Invitations to present keynote presentations at national and international scientific conferences.

Award holders were asked to report on all activities of knowledge creation and scientific dissemination in their end of grant (EOG) report.

**Table 1: Summary of scientific dissemination outputs, 2018–19, compared to previous reporting periods**

Knowledge creation	2018–19 (N=170 awards)	2016–17 (N=187 awards)	2014–15 (N=198 awards)	2012–13 (N=134 awards)	2010–11 (N=196 awards)	2008–09 (N=204 awards)
<b>Peer-reviewed publications</b>						
Total number of peer-reviewed journal publications	792	849	693	584	470	526
Average number of peer-reviewed papers per award	4.6	4.5	3.5	4.5	2.4	2.5
Percentage of papers in open access journals and/or on open publishing platforms	85%	70%	56%	N/A	N/A	N/A
Average number of publications per €1 million spend	16.0	17.8	12.6	13.3	8.6	11.6
<b>Scientific presentations</b>						
Number of scientific presentations	1,560	1,524	1,414	940	1,427	1,118
Number of keynote presentations internationally	20	23	21	35	35	51
Percentage of award holders reporting at least one other scientific dissemination activity	81%	70%	72%	96%	87%	92%

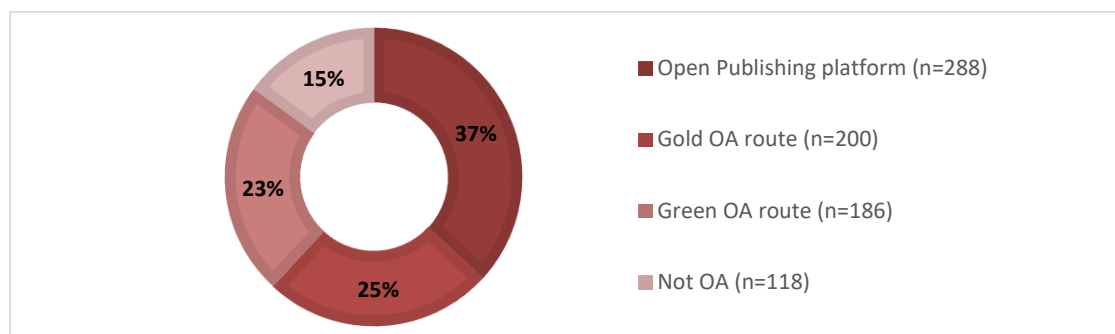
\*N/A = data on all metrics was not available in every reporting period

## Key Findings

### Peer reviewed journal papers

- A total of 792 peer-reviewed publications were reported by holders of awards that ended in 2018–19. Sixty-eight per cent of awards (n=115) reported at least one peer-reviewed publication at EOG, with an average of 16.0 publications per €1 million spend and an average of 4.6 peer-reviewed publications per grant, although there was variation in award type and broad research area.
- Eighty-five per cent of papers were published in open access compliant journals or on open publishing platforms in 2018–19 compared to 70% and 56% in 2016–17 and 2014–15, respectively.
- Projects and Programmes awards produced the greatest number of publications, followed closely by Capacity Building and Leadership Enhancement awards, then Infrastructure and Networks awards (49%, 44%, and 7%, respectively).

- Health Services Research produced the greatest number of papers (n=20.6) per €1 million spend, followed by Population Health Sciences (N=15.2), Clinical Research (n=14.0), and Applied Biomedical Research (n=10.8).



**Figure 3: Number of publications in open access journals and open publication platforms, 2018-19**

### Other means of scientific dissemination

- A total of 112 non-peer-reviewed publications were reported, most notably 28 technical reports, 22 invited reviews, and 16 articles in professional bulletins and magazines.
- HRB-funded award holders are very active in disseminating their work to peers at both national and international scientific events, with 1,560 activities recorded by 81% (n=138) of award holders.
- A total of 20 international and 11 national keynote presentations were reported, with the highest proportion of these being in Clinical Research (40%, n=8). A total of 127 international invited speaker addresses were reported, the highest proportion of which were in Applied Biomedical Research (38%, n=49), followed by Clinical Research (32%, n=41) and Population Health Sciences (22%, n=28).

**Table 2: Other scientific publications, 2018-19**

	National	International	Total
Technical report	28	4	<b>32</b>
Invited review	13	9	<b>22</b>
Article	11	5	<b>16</b>
Journal editorial	7	8	<b>15</b>
Chapter in edited book	1	14	<b>15</b>
University publication	3		<b>3</b>
Conference abstract		3	<b>3</b>
Health report	1	1	<b>2</b>
Industry bulletin	2		<b>2</b>
Book	1		<b>1</b>
Infographic	1		<b>1</b>
<b>Total</b>	<b>68</b>	<b>44</b>	<b>112</b>

## 2.4 Capacity-building and Leadership

A key strategic objective for the HRB is to embed research into the health system by:

- Building capacity for research among health professionals and other professionals who can contribute to a multidisciplinary research environment
- Supporting young researchers as they progress to become independent investigators, and
- Supporting established researchers to strengthen their reputation as world leaders in their field.

Measures of success in terms of capacity building include the development of not only human capacity, but also indicators of the extent to which HRB award holders are advancing their field, and the quality and impact of award holders' research as perceived by their peers through recognition and academic awards.

**Table 3: Summary of capacity building outputs, 2018–19, compared to previous reporting periods**

Research capacity building	2018–19 (N=170 awards)	2016–17 (N=187 awards)	2014–15 (N=198 awards)	2012–13 (N=134 awards)	2010–11 (N=196 awards)	2008–09 (N=204 awards)
<b>Human capacity outputs</b>						
Total number of research-related posts created	451	329	385	422	280	296
Number of PhD students trained	103	77	93	133	72	88
Number of postdoctoral researchers supported	136	124	154	130	92	112
Percentage of cohort from health professional background	39.0%	40.1%	43.6%	32.2%	29%	N/A*
Average number of posts per award	2.7	1.8	1.9	3.1	1.4	1.4
<b>Recognition and academic awards</b>						
Percentage of awards reporting indicators of peer recognition	44.0%	53.5%	42.9%	70.0%	75.0% (2011 only)	N/A*

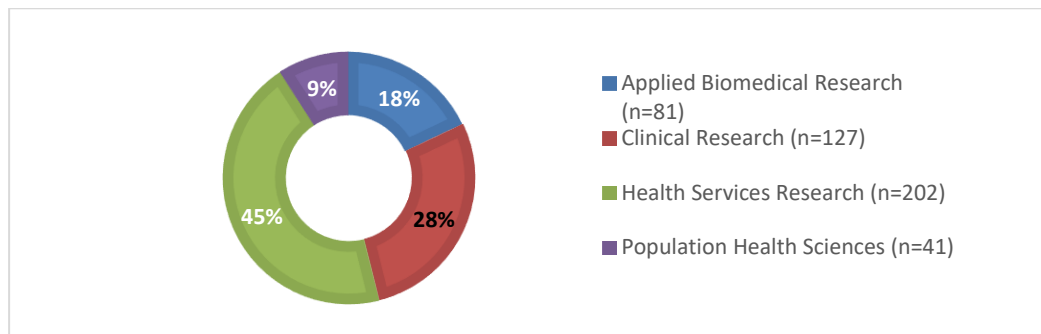
\* N/A – data on all metrics are not available for every reporting period.

### Key Findings

#### Posts created via Health Research Board awards

- In total, 451 research-related posts were created. Of these, 39.0% of positions were filled by people from a health professional background (medical doctors, nurses, and allied health professionals).
- The majority of the 451 research-related roles were at postdoctoral level (n=136) and research assistant level (n=130).
- Projects and Programmes awards accounted for 74% of the posts created (n=335), representing 10.4 posts per €1 million spend. Capacity Building and Leadership Enhancement awards accounted for 25% of the total number of posts created (n=114), with 6.8 posts per €1 million spend. The Infrastructure and Networks award accounted for 0.5% of the posts created, with 2.6 posts per €1 million spend.
- For the first time, Health Services Research accounted for the most posts created (n=202, 45%), followed by Clinical Research (n=127, 28%), Applied Biomedical Research (n=81, 18%), and Population Health Sciences (n=41, 9%).

- A total of 103 people were enrolled in PhD programmes, chiefly in the PhD Scholars Programmes, and 6 received master's degrees.



**Figure 1: Breakdown of total number of posts created, by broad research area, 2018-19**

### **Next destination**

- By far the most common sector for follow-on employment was academia (n=284). The remainder of the personnel were employed in clinical practice (n=55), other professions (n=60) or in industry (n=52).
- The most common follow-on roles were as a postdoctoral researcher (n=87), in a PhD position (n=39), or in research management (such as data managers and biostatisticians) (n=39).
- Thirty-nine people were recorded as lecturers at third-level institutions, 30 people had taken up roles in the health services, and 21 people were employed as research assistants. Eighteen people were now working as full-time medical doctors; 2 as full-time clinical nurses or midwives; and 5 in allied health professional roles, including dietitians, physiotherapists, and psychologists.
- Following completion of their HRB-funded award, 51 people had secured employment in the private sector, characterised as 'industry'. Most of these people had a background in biomedical science. This is a strong indicator that the skills development and training acquired by people who participated in HRB awards had value outside of academia and the health system.
- Most personnel (87%, n=392) were employed in Ireland or Northern Ireland, while the remainder moved overseas, with the United Kingdom as the most popular destination.

### **Awards, prizes, and other recognition**

- A total of 324 awards, prizes, and other forms of recognition were reported by 44% of the award holders. Research prizes, medals, or other forms of acclaim were the most common types of recognition reported. HRB award holders were also invited to contribute as keynote speakers internationally, to sit on organising committees of international scientific conferences, and to participate in international scientific bodies such as scientific advisory committees.
- Twenty award holders were appointed to the editorial boards of journals or book series, and 32 were invited onto scientific conference organising committees.
- Thirteen people received prestigious/honorary positions with an external body.
- The types of awards and recognition that HRB and Medical Research Council (MRC) award holders attracted were very similar, despite the different scales and remits of these organisations.

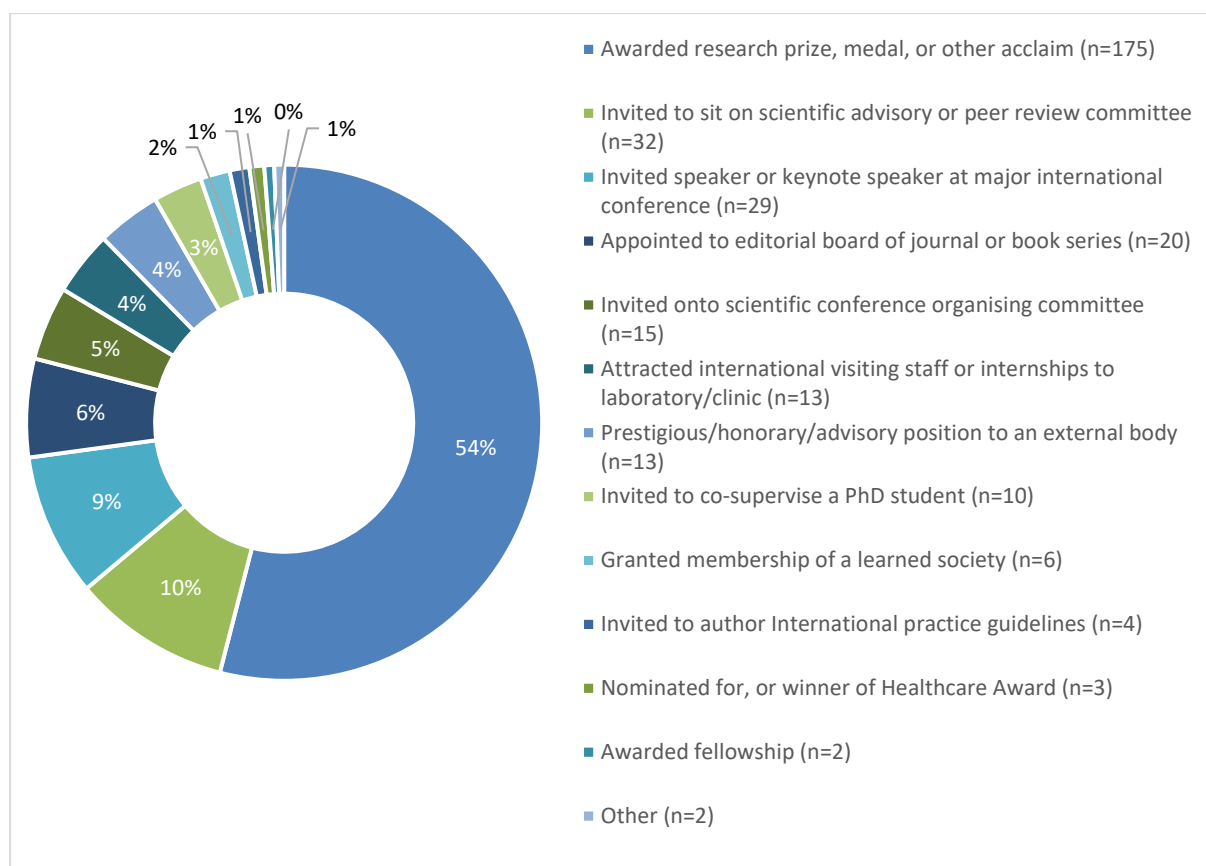


Figure 5: Number of awards reporting research awards, research prizes, and recognition, per type, 2018-19

## 2.5 Collaborations and leveraged funding

The development of research collaborations and partnerships with national and international researchers, charities, policymakers, and health bodies is an important indicator of the quality and potential future impact of HRB-funded research. The development of collaborations is also vital to the leveraging of research funding. The leveraged funding reported here was additional to the original HRB award and such funding was obtained through awards from Irish Exchequer sources (HRB, SFI, IRC etc.), as well as from national and international non-exchequer sources (charities, industry, EU funding programmes etc.)

Table 4: Summary of research collaboration and partnership outputs, 2018–19, compared to previous reporting periods

Research collaborations and leveraged funding	2018–19 (N=170 awards)	2016–17 (N=187 awards)	2014–15 (N=198 awards)	2012–13 (N=134 awards)	2010–11 (N=196 awards)	2008–09 (N=204 awards)
<b>Research collaborations and partnerships</b>						
Total number of academic collaborations, partnerships, or networks	396	399	413	278	415	384
Percentage of academic collaborations with health bodies	9%	16%	19%	14%	10%	N/A*
Average number of academic collaborations, partnerships, or networks per €1 million spend	8.0	8.5	7.5	6.3	7.6	8.5

Research collaborations and leveraged funding	2018–19 (N=170 awards)	2016–17 (N=187 awards)	2014–15 (N=198 awards)	2012–13 (N=134 awards)	2010–11 (N=196 awards)	2008–09 (N=204 awards)
<b>Further funding leveraged</b>						
Number of additional research awards leveraged	174	200	180	149	113	117
Total value of leveraged funding	€100.4 million	€57.6 million	€41.8 million	€39.5 million	€34.8 million	N/A
Amount of leveraged funding per €1 spend	€2.02	€1.20	€0.76	€0.89	€0.64	N/A

\*N/A – data not collected on this metric in every reporting period

**Key Findings**

**Collaborations and partnerships**

- 131 (70%) of HRB award holders whose awards ended in 2018–19 reported participation in 396 collaborations/partnerships during the lifetime of their award, of which partnerships, or networks reported, 286 (72%) involved an academic institution and 35 (9%) involved a hospital.
- A significant number of collaborations were established with policy-focused or service delivery-focused health organisations, health charities, or voluntary and community groups.
- The most popular reasons for collaborating with academic or other partners were to conduct joint research, form networks, or access methodological support/advice. Shared data and research findings, and access to research materials, tools, or instruments, as well as access to cohorts, were also deemed important reasons for collaborating.
- The highest proportion of collaboration was found in Projects and Programmes awards and awards classified as Health Services Research.

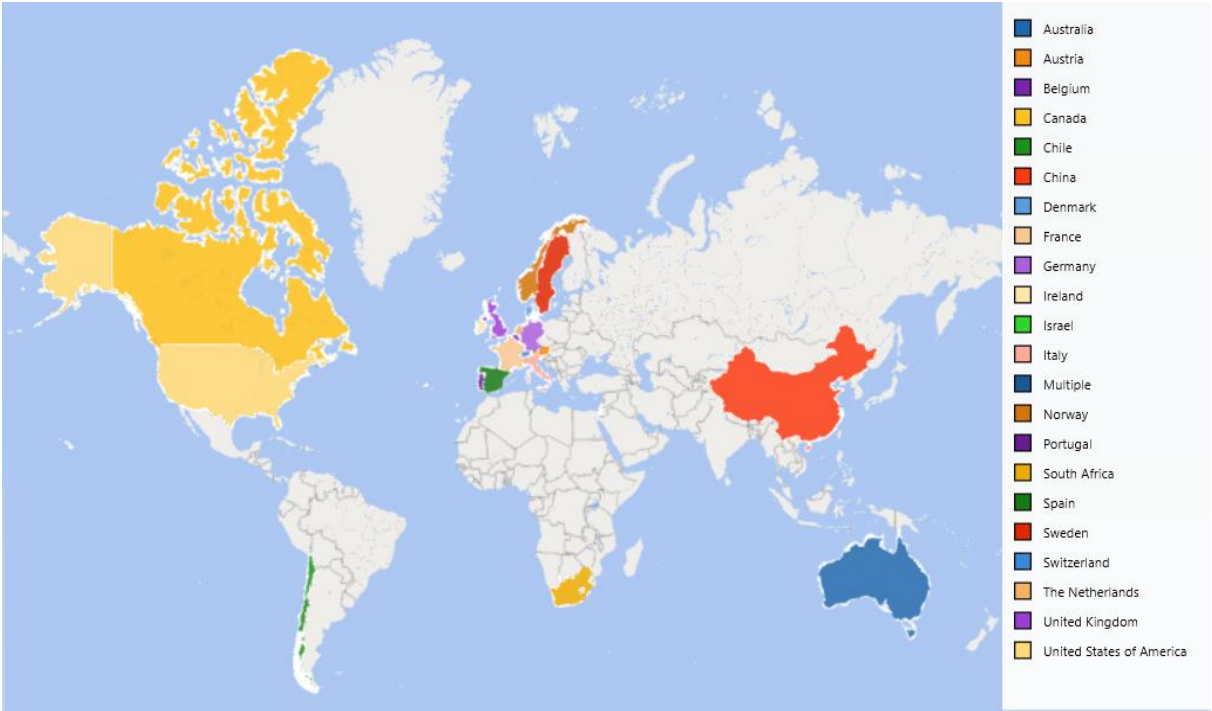


Figure 6: Map of collaborations established by HRB awards-holders, 2018-19

### Leveraged funding

- Almost one-half of awardees were successful in securing additional funding by leveraging their HRB award. This is the same as the proportion of MRC award holders that reported at least one instance of further funding in the same reporting period.
- A total of 174 additional awards were reported by 73 awardees, with a total value to HRB awardees of €100.4 million. This is significantly higher than the €57.6 million recorded in 2016–17. Approximately €70.5 million came from Irish exchequer sources, while €29.9 million came from non-exchequer sources in Ireland and overseas. The amount of non-exchequer leveraged funds received increased from €16.6 million in 2016–17.
- The amount of funding leveraged per €1.00 of HRB investment was €2.02. The 2018–19 and 2016–17 reporting periods are the two instances in since the 2008-2009 reporting period where the amount leveraged has exceeded the original HRB investment. Furthermore, €2.03 leveraged per €1.00 invested in 2018–19 is almost double the return reported in 2016–17.
- Projects and Programmes awards accounted for 78% of all leveraged awards and 91% of the total amount leveraged, representing a return on investment of €2.86 for every €1.00 spend. This is a significant increase compared to the €1.45 leveraged per €1.00 spend in 2016–17.
- Applied Biomedical Research awards accounted for 32% of all leveraged awards, followed by Clinical Research with 31% of all leveraged awards. These research areas returned €3.85 and €3.30, respectively, for every €1.00 invested.

**Table 5: Number and value of awards leveraged by HRB award holders, 2018–19**

Source of funding	Number of awards	Percentage of total amount leveraged	Value of leveraged funding
<b>Exchequer (€70,501,243)</b>			
HRB	53	15.6%	€15,627,090
Science Foundation Ireland	16	48.3%	€48,469,291
Enterprise Ireland	6	3.5%	€3,544,175
Irish Research Council	15	1.7%	€1,697,235
HSE	7	1.0%	€1,033,797
Organisations for medical professionals	2	0.1%	€59,202
Government department	2	0.1%	€70,453
<b>Non-exchequer (€29,895,699)</b>			
EU Framework programme	23	14.8%	€14,821,856
Charity – national	11	0.6%	€651,750
Charity – international	9	1.9%	€1,873,748
EU – other programmes	7	7.3%	€7,294,580
International funding agency	6	2.7%	€2,759,266
Industry – international	6	1.6%	€1,647,500
Co-funded with international partners	3	0.6%	€612,693
Health and social care provider	3	0.2%	€153,454
University – national	2	0.0%	€30,000
Industry – national	2	0.1%	€50,852

## 2.6 Informing policy and practice

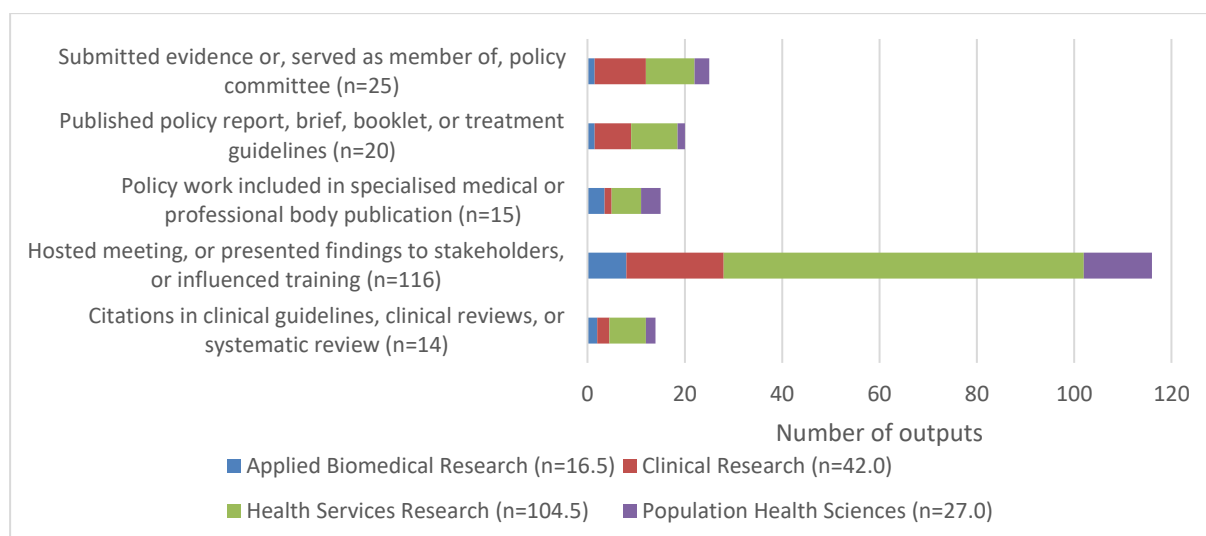
Translating research into improved policies and practices is a strategic driver for the HRB. This translation occurs in many ways, but engagement – communicating and exchanging information and expertise – between researchers, the public, and policy-makers is crucial. Indicators that HRB award holders are working to achieve outputs and outcomes in this realm include efforts to ensure that research evidence can contribute to policy development and improvements in clinical practice, and contribute evidence to, or be actively involved in, clinical guideline development, curriculum development, and regulation.

**Table 6: Summary of policy and practice outputs, 2018–19, compared to previous reporting periods**

Health policy and clinical practice outputs/influences	2018–19 (N=170 awards)	2016–17 (N=187 awards)	2014–15 (N=198 awards)	2012–13 (N=134 awards)	2010–11 (N=196 awards)	2008–09 (N=204 awards)
Total number of policy and practice outputs	190	187	105	127	99	84
Percentage of awards reporting policy and practice outputs	43.0%	44.9%	26.8%	38.0%	24.0%	20.0%
Average number of policy and practice outputs per €1 million spend	3.8	3.8	1.9	2.9	1.8	0.9

### Key Findings

- Overall, the number of awards reporting policy and practice outputs continues to increase each year, with 190 policy and practice outputs reported in 2018–19.
- The most common approach to disseminating research results in the policy and clinical practice spheres was to present findings to relevant stakeholders (policy-makers, health managers, etc.) through seminars, workshops, and face-to-face meetings.
- The likelihood of a PI seeking to influence policy or clinical practice was strongly associated with the type of research being undertaken, with Health Services Research and Population Health Sciences being the most productive research areas in terms of outputs per €1 million spend. This is consistent with trends in previous reporting periods.
- Award holders employed a range of influencing strategies in order to achieve specific impacts, with particular emphasis on influencing the development of policy and informing product/ service/ programme development and evaluation.
- From 2008 to 2019, the average share of awards reporting at least one instance of a policy and practice output is 33%. This is higher than the 25% of MRC award holders who reported policy influences over a similar time frame.



**Figure 7: Types of policy and practice outputs, per broad research area, 2018-19**

## 2.7 Non-academic engagement activities

Engaging with audiences outside of academia is an important part of the research process. Wider dissemination of research findings to non-scientific audiences is vital for improving the public understanding of complex research topics, for recruiting patients to clinical trials and engaging the public in the design and conduct of research, and for communicating the benefits and value of health research to non-scientific stakeholders. Involving patients, carers and the public in the conception, design, analysis, and reporting of research activity adds considerable value and relevance and increases the potential for uptake of the evidence generated.

**Table 7: Summary of non-academic engagement, and PPI outputs, 2018–19, compared to previous reporting periods**

Activity type	2018–19 (N=170 awards)	2016–17 (N=187 awards)	2014–15 (N=198 awards)	2012–13 (N=134 awards)	2010–11 (N=196 awards)	2008–09 (N=204 awards)
<b>Non-academic engagement</b>						
Total number of non-academic engagement activities	473	531	258	188	122	N/A
Percentage of award holders reporting non-academic engagement activity	60%	71%	48%	50%	35%	N/A
Average number of non-academic engagement activities per €1 million spend	9.5	11.2	4.7	4.6	2.2	N/A
Average number of non-academic engagement activities per award	2.8	2.8	1.3	1.4	0.6	N/A
<b>Public and patient involvement (PPI)</b>						
Percentage of awards reporting PPI activities	45.0%	21.9%	N/A	N/A	N/A	N/A
Number of PPI activities reported	575	354	N/A	N/A	N/A	N/A

\* N/A indicates that these engagement outputs were not included in the survey for that reporting period.

## Key Findings

- Sixty per cent of award holders reported 473 non-academic engagement outputs.
- Participation in workshops, open days or similar activities, and presentations to non-academic audiences were the most popular forms of engagement. A similar distribution is evidenced in MRC data. There was an increase in award holders reporting the use of online publications and blogs to disseminate their research findings.
- Projects and Programmes awards were the most productive award types in terms of engagement outputs per €1 million spend (12.4), and Population Health Sciences was the most productive broad research area in terms of engagement outputs per €1 million spend (13.2).
- From 2010 to 2019, the average number of award holders reporting non-academic engagement activity was 53%, which is similar to the 64% reported by MRC award holders.
- In terms of PPI in research, 80 award holders (45% of total) reported 575 PPI activities during the period of their research project. This is a significant increase from the figures reported in the 2016–17 reporting period.

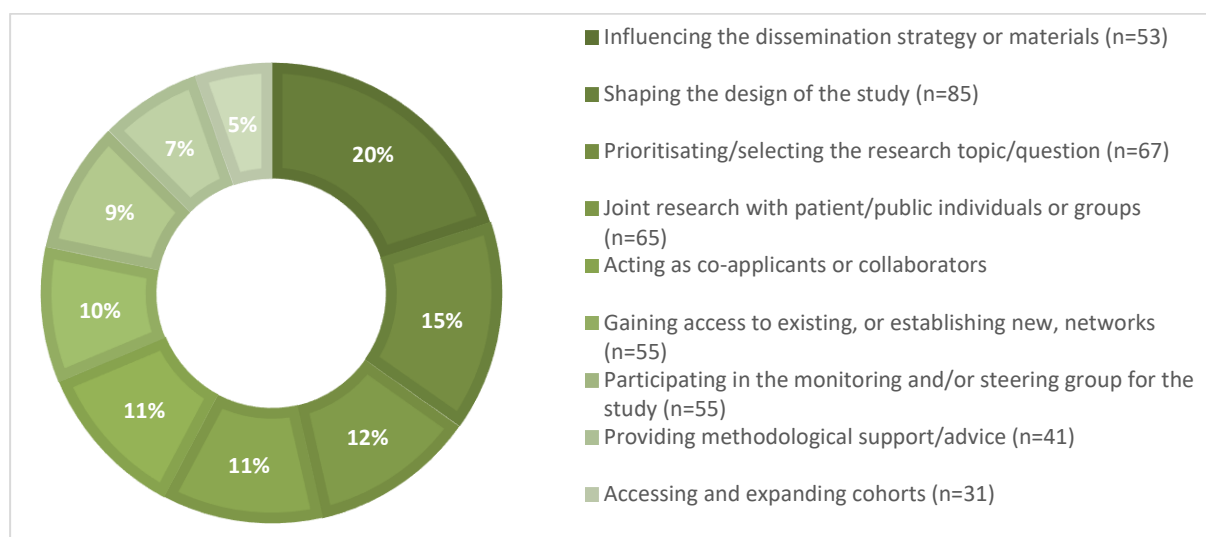


Figure 8: Purpose of PPI activities undertaken by HRB award holders, 2018-19

## 2.8 New research tools, materials, and methods

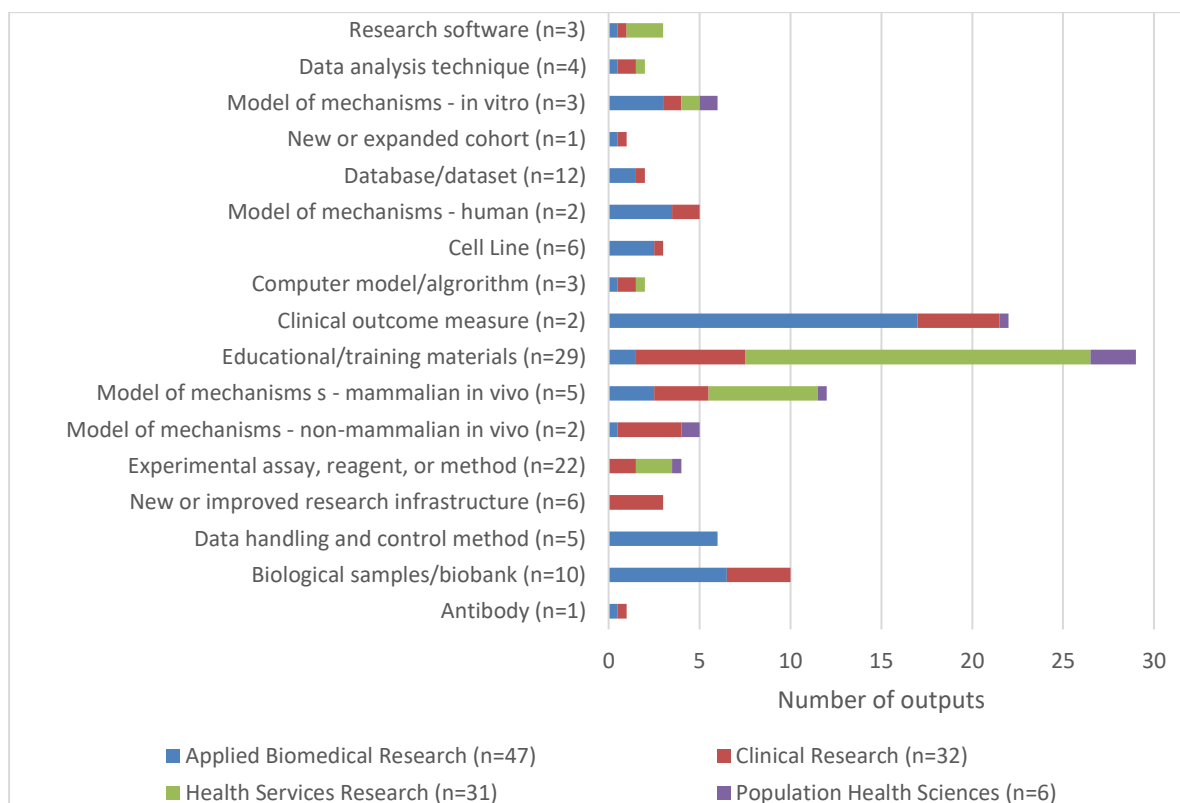
One indicator of the extent to which HRB award holders are advancing research within their field both nationally and internationally is the development or application of novel research tools, materials, methodologies, and/or technologies. These may include new biological models, biobanks and datasets, techniques, etc. Although they are usually generated in order to advance the objectives of a specific project, they may be used more widely by other researchers and can facilitate new lines of enquiry or accelerate research in related fields.

**Table 8: Summary of research tools, materials, and methods outputs, 2018–19, compared to previous reporting periods**

Development of research tools, materials, and methods	2018–19 (N=170 awards)	2016–17 (N=187 awards)	2014–15 (N=198 awards)	2012–13 (N=134 awards)	2010–11 (N=196 awards)	2008–09 (N=204 awards)
Total number of new materials/methods developed	116	113	96	112	85 (2011 only)	N/A
Average number of outputs per €1 million spend	2.3	2.4	1.8	2.9	1.6	0.6

### Key Findings

- Thirty-six per cent of award holders reported the development of one or more novel research materials or methods wholly or partly because of their HRB award.
- The most common type of research material developed was educational and training material, followed by an experimental assay, reagent, or method, and a dataset/database.
- Projects and Programmes awards produced 91% of novel materials or methods.
- The broad research areas of Applied Biomedical Research and Clinical Research accounted for 41% of all novel materials or methods. The most commonly reported outputs for Applied Biomedical Research awards were experimental assays, reagents, or methods, whereas all other research areas reported educational or training materials as their most commonly generated outputs.



**Figure 9: Breakdown of new tools, materials, or methods, per broad research area, 2018-19**

## 2.9 Healthcare innovations

Health research is the basis for many products and innovations in the commercial life sciences, medical technology and biotechnology sectors, as well as for developments in treatment and service innovations in the healthcare sector. Such products and innovations can emerge through new ideas or intellectual property, or the application or enhancement of existing ideas or intellectual property.

**Table 9: Summary of healthcare innovations in the 2018–19 reporting period, compared to previous reporting periods**

Healthcare innovations	2018–19 (N=170 awards)	2016–17 (N=187 awards)	2014–15 (N=198 awards)	2012–13 (N=134 awards)	2010–11 (N=196 awards)	2008–09 (N=204 awards)
Total number of healthcare innovations	57	57	54	43	48	32
Percentage of awards reporting healthcare innovations	24%	22%	21%	25%	21%	15%
Average number of healthcare innovations per €1 million spend	1.4	1.2	1.0	1.0	0.9	0.7

### Key Findings

- Forty-one award holders reported that their HRB-funded research had either directly led to or contributed to the development of a total of 57 healthcare innovations, and 14 (34%) award holders had already attracted further funding, including one source of funding from industry.
- The most commonly reported healthcare innovation was the creation of films, animations, or videos, followed by non-imaging diagnostic tools, care models/services, and clinical decision support tools.
- Fourteen per cent (n=8) of innovations were in early-stage development, while a further 46% (n=26) were in the later stages of development or were being tested, trialled, or refined as part of the award. Thirty-two per cent (n=18) of innovations had been adopted on a small scale while 7% (n=4) had been adopted on a large scale.
- Projects and Programmes awards accounted for 81% of the total healthcare innovations.
- Health Services Research accounted for the largest proportion of healthcare innovations by broad research area (42%, n=24.0) compared to Clinical Research (36%, n=20.5), Applied Biomedical Research (17%, n=9.5), and Population Health Sciences (5%, n=3.0).
- From 2008–09 to 2018–19, the average percentage of awards reporting healthcare innovations was 21%, with the highest average number of healthcare innovations recorded in 2018–19, at 1.4 innovations per award. This reflects an upward trend in this metric since 2008 and is higher than the MRC-reported average of 16% of awards reporting healthcare innovations during this period.

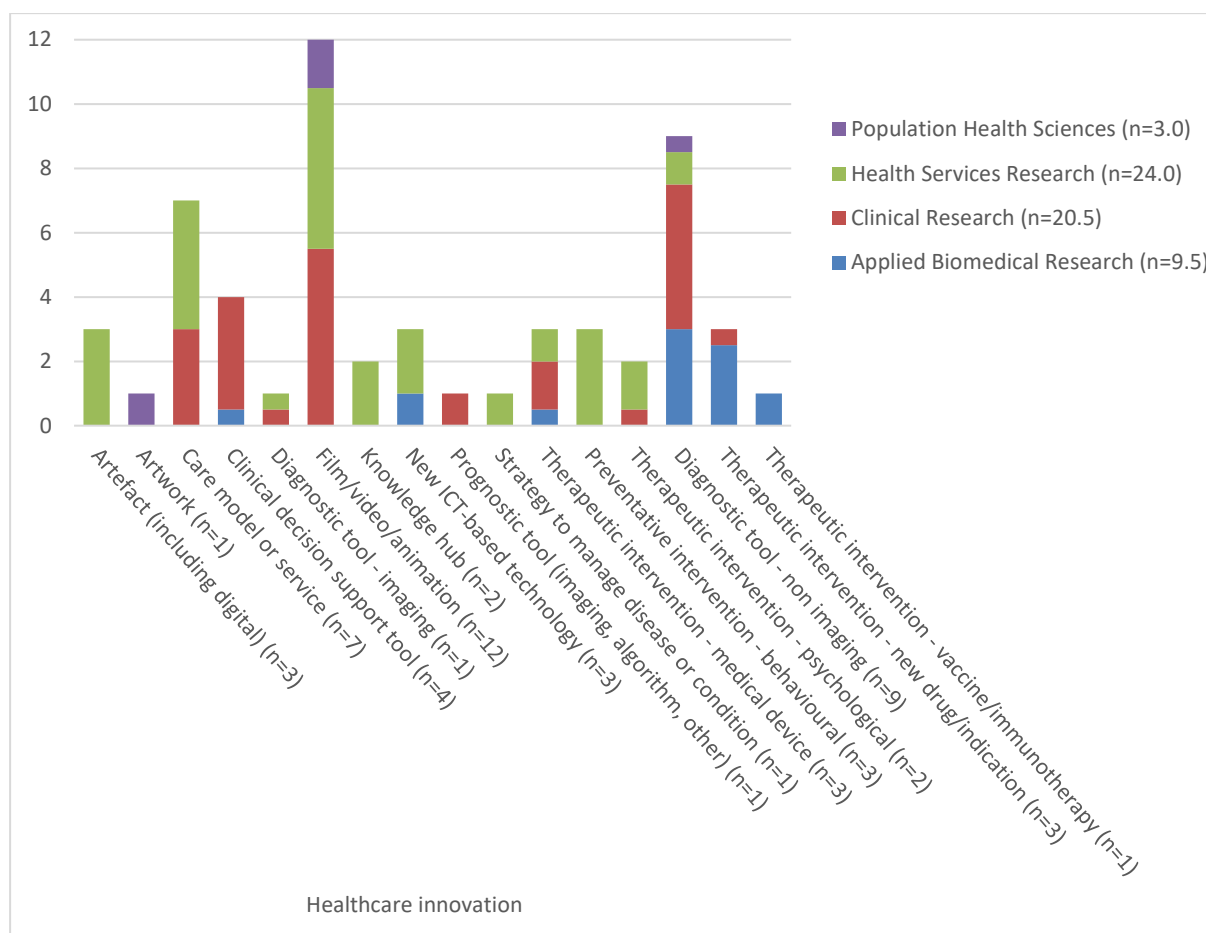


Figure 10: Number of healthcare innovations, per innovation type and broad research area, 2018–19

## 2.10 Commercialisation and economic benefit

The primary focus of HRB-funded research investment is on the generation of opportunities for improved healthcare delivery and better health outcomes, and on the generation of research evidence in order to inform policy and improve clinical practice. The successful commercial exploitation, or ‘commercialisation’, of intellectual property arising from health research can result in economic benefits through job creation and the development of products and services by converting scientific and technological advances into marketable products or industrial processes.

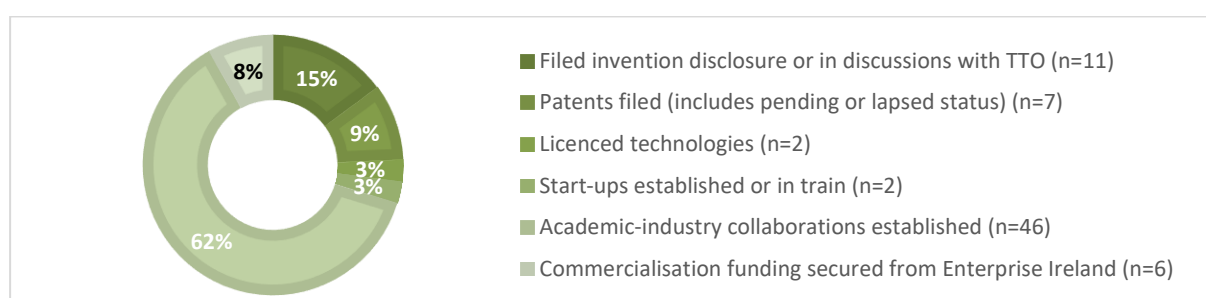
Table 10: Summary of commercialisation activity, 2018–19, compared to previous reporting periods

Commercialisation and enterprise activity	2018–19 (N=170 awards)	2016–17 (N=187 awards)	2014–15 (N=198 awards)	2012–13 (N=134 awards)	2010–11 (N=196 awards)	2008–09 (N=204 awards)
Number of filed invention disclosures or disclosures in discussion with Technology Transfer Office (TTO)	11	25	5	20	9	9
Number of patents/copyrights/trademarks filed	7	10	24	16	11	12

Commercialisation and enterprise activity	2018–19 (N=170 awards)	2016–17 (N=187 awards)	2014–15 (N=198 awards)	2012–13 (N=134 awards)	2010–11 (N=196 awards)	2008–09 (N=204 awards)
Number of licensed technologies developed	2	5	2	5	3	3
Number of start-ups/spin-outs established	2	2	4	2	2	2
Number of academic-industry collaborations established	46	59	58	88	25	10
Number of commercialisation awards secured from Enterprise Ireland	6	2	9	5	4	6

### Key Findings

- HRB award holders were active in industry collaboration and exploitation of intellectual property arising from health research, with 74 commercial and enterprise outputs reported by 33 award holders (19% of total award holders).
- Eleven award holders had discussed the commercial potential of their work with a university Technology Transfer Office or potential industry partner, seven award holders had filed patents, copyrights, or trademarks and five award holders had secured commercialisation funding from Enterprise Ireland to further develop their ideas.
- Two award holders had negotiated licensing agreements (one exclusive and one non-exclusive royalty-bearing licence), and two start-ups were reported.
- Projects and Programmes awards reported the highest number of commercialisation outputs (n=27, 95%), representing 0.7 outputs in this category per €1 million spend.
- Applied Biomedical Research and Clinical Research were equally as likely to produce commercialisation outputs of all types and accounted for almost 80% of all commercialisation outputs by broad research area (39% each), and both research areas also matched on productivity, with 0.7 outputs per €1 million invested.
- Forty-six instances of new or strengthened academic–industry collaborations were identified by 16 award holders, of which 63% (n=29) were international collaborations.
- Collaboration for the purpose of conducting joint research projects was the most common reason for engaging with industry (35%). Gaining access to material, cohorts, or datasets (21%), infrastructure or equipment (11%), and networking opportunities (11%), as well as sharing data and/or expertise (11%), were also important reasons for collaboration cited by HRB award holders.



**Figure 11: Distribution of commercialisation outputs, 2018–19**

## 2.11 Data usage

The HRB supports and promotes research that will improve people's health, patient care, and health service delivery. The primary output from the research projects funded by the HRB is often the data gathered and generated to support observations and validate the projects. In order to ensure that these data are used to their maximum potential, data need to be adequately managed from the earliest stage in the research process and should be preserved and made available for reuse beyond the original project. The HRB promotes the FAIR data principles (findable, accessible, interoperable, reusable) of open data – which aim to ensure that data are findable, accessible, interoperable, and reusable – to award holders. Furthermore, the HRB supports the use of secondary analysis by HRB-funded award holders in order to reduce research waste and redundancy in the research system.

Award holders reporting awards that finished in 2018–19 were asked about the level of data deposition, about the secondary analysis of data, and about additional details regarding data linkage. This is the first time that this information is being presented in an HRB research outputs report.

### Key findings

- Of the 170 award holders surveyed, only 10 award holders confirmed that the data generated from their HRB-funded research were added to an archive/repository. These awards spanned all broad research areas, with the Applied Biomedical Research and Clinical Research areas recording the highest number of awards (4.5 and 4.0, respectively).
- Three of the repositories used by award holders were Irish, four were European, two were American, and one was British.
- A total of 37 examples of secondary analysis of data were recorded from awards that ended in 2018–19. Much of the data originated in Ireland (78%, n=29); however, there was a reasonable number of international datasets accessed.
- Projects and Programmes awards accounted for 84% (n=31) of the overall total secondary analyses. Capacity Building and Leadership Enhancement awards accounted for 16% (n=6). Most awards reporting secondary analysis were categorised as Health Services Research (62%, n=28.0).
- Health Research Awards were most likely to carry out secondary analysis of data, reporting 26 instances (70%) of secondary analysis across seven unique awards.
- A total of 15 examples of data linkage were reported, with Projects and Programmes awards accounting for the highest level of data linkage activity, with 93% (n=14) of total data linkage instances.
- Almost one-half (47%, n=7) of the award holders reported difficulties with data linkage.

## Appendix A Impact Assessment (“Payback Framework”)

Table 11: ‘Payback Framework’ impact categories and indicators (based on Buxton and Hanney)

Impact category	Indicators
<b>Knowledge creation</b>	<ul style="list-style-type: none"> <li>• Peer-reviewed publications and citations</li> <li>• Other publications, such as books, book chapters, editorials, or bulletins</li> <li>• Presentations to national and international conferences</li> <li>• Research reports and grey literature produced, and</li> <li>• Cochrane systematic reviews produced, or findings included in a review</li> <li>• Invited keynote presentations to international conferences; and involvement of HRB-funded researchers in international research programmes)</li> </ul>
<b>Capacity building and leadership</b>	<ul style="list-style-type: none"> <li>• Education and training of personnel such as clinicians, health professionals, and scientists</li> <li>• Higher degrees, such as PhDs, obtained by research personnel</li> <li>• Retention rates of research personnel in national research or the health system</li> <li>• Development and use of novel research techniques</li> <li>• Establishment of new datasets or databases, or research data lodged in national databases</li> <li>• New national/international collaborations or strategic partnerships formed with other research teams, industrial partners, or health agencies, and</li> <li>• Internationalisation of research: involvement of researchers funded by the Health Research Board (HRB) with European Union and global health research initiatives.</li> </ul>
<b>Informing policy, practice and the public</b>	<ul style="list-style-type: none"> <li>• Influencing national and international research policies and strategies</li> <li>• Dissemination and knowledge-transfer events or networks established with research users, such as policy-makers and health professionals</li> <li>• HRB-funded researchers in advisory roles to government or policy-makers</li> <li>• Policy briefing papers, practical handbooks, and other grey literature material produced and disseminated to research users, such as policy-makers and health professionals</li> <li>• Contribution of research to clinical treatment or best practice guidelines, and</li> <li>• Evidence of public outreach and dissemination through media and other fora.</li> <li>• Inclusion of PPI in research design, conduct, analysis and dissemination</li> </ul>
<b>Healthcare innovations</b>	<ul style="list-style-type: none"> <li>• Contribution of HRB-funded research to health promotion initiatives</li> <li>• Randomised controlled trials completed, and new interventions established as a result</li> <li>• Numbers of patients enrolled in clinical trials or engaged with studies undertaken in clinical research facilities supported by the HRB</li> <li>• Contribution of HRB-funded research to actual health benefits within the Irish population</li> <li>• Savings to the health system through gains in health service efficiency, improved primary care, or the introduction of preventative health measures, where research and evidence generated by HRB-funded researchers contributed to this, and</li> <li>• Increased availability of a local pool of evidence and ‘evidence generators’ to Irish health policy-makers and health practitioners.</li> </ul>

Impact category	Indicators
<p><b>Commercialisation and economic benefits</b></p>	<ul style="list-style-type: none"> <li>• Improvement of Ireland’s international reputation for health and medical research (e.g., by attracting pharmaceutical industry research and development and collaborative partnerships with HRB-funded researchers)</li> <li>• Patents and other intellectual property applications and the distribution of commercialisation support awards to develop marketable products or devices</li> <li>• Licence agreements and revenues generated as a result of these</li> <li>• Spin-out companies created, or formal collaborative partnerships formed between researchers and industry</li> <li>• Success of HRB-funded personnel in attaining additional research funding, for example through the European Union’s Framework Programmes</li> <li>• Success of HRB-funded researchers in obtaining Enterprise Ireland funding for further development of potentially viable enterprise outputs of the research.</li> </ul>

## Appendix B Summary of key indicators from awards ending in 2018–19, by award type

Table 12: Summary of key payback indicators from awards ending in 2018–19, per award type

Impact category/key indicator (total no.)	Projects and Programmes (n=128 awards)	Capacity Building and Leadership Enhancement (n=41 awards)	Infrastructure and Networks (n=1 award)
<b>Amount invested (€)</b>	<b>€32,051,601</b>	<b>€16,669,831</b>	<b>€761,835</b>
<b>1. Knowledge creation</b>			
Total number of peer-reviewed publications (n=792)	388	350	54
Mean number of peer-reviewed publications per award	3.0	8.5	54.0
Average number of publications per €1 million spend	12.1	21.0	71.1
Number of scientific presentations (n=1560)	954	578	28
Number of keynote presentations internationally (n=20)	19	1	0
<b>2. Capacity building and leadership</b>			
Total number of research-related posts created (n=451)	335	114	2
Number of PhD degrees (n=103)	42	61	0
Number of postdoctoral researchers supported (n=136)	121	15	0
Number of researchers from a health professional background (n=176)	142	34	0
Number of researchers remaining in the national health or research system (n=339)	253	85	1
Number of awards reporting indicators of peer recognition (n=324)	216	108	0
Number of research collaborations established (n=396)	247	138	11
Number of collaborations with health bodies or government agencies (n=35)	21	14	0
Number of new research methods, materials, datasets, or tools developed (n=116)	105	11	0
Number of leveraged additional awards (n=174)	136	33	5
Value of funding leveraged by HRB researchers (total=€100.4 million)	€91,674,796	€8,026,747	€675,399
<b>3. Informing policy, practice, and the public</b>			
Total number of policy/practice outputs (n=190)	137	53	0
Average number of policy and practice outputs per €1 million spend	4.3	3.2	0.0
Number of advisory roles to government or policy-makers (n=16)	14	2	0
Number of policy briefings, practical handbooks, etc. disseminated to research users (policy-makers, health professionals, etc.) (n=9)	6	3	0

**Outputs, outcomes, and emerging impacts: Results of HRB awards that completed in 2018 and 2019**

Impact category/key indicator (total no.)	Projects and Programmes (n=128 awards)	Capacity Building and Leadership Enhancement (n=41 awards)	Infrastructure and Networks (n=1 award)
<b>Amount invested (€)</b>	<b>€32,051,601</b>	<b>€16,669,831</b>	<b>€761,835</b>
Number of contributions to clinical treatment or best practice guidelines (n=14)	5	9	0
Number of policy/health system/public engagement outputs (n=473)	398	67	8
Average number of policy/health system/public engagement outputs per €1 million spend	12.4	4.0	10.5
Number of public and patient involvement (PPI) outputs (n=575)	469	86	20
<b>4. Healthcare innovations</b>			
Total number of healthcare innovations developed (n=57)	46	11	0
Number of therapeutic interventions (behavioural, drug, cell, vaccine, device) (n=10)	9	1	0
Number of preventative interventions ((behavioural) (n=3)	3	0	0
Number of prognostic or diagnostic tools (n=11)	9	2	0
Number of care models and clinical decision support tools (n=12)	7	5	0
Number of innovations in the design/pilot/feasibility/proof-of-concept/trial stages (n=34)	28	6	0
Number of innovations adopted in the health system (small or large scale) (n=22)	17	5	0
Average number of healthcare innovations per €1 million spend	1.4	0.7	0.0
<b>5. Commercialisation and economic benefits</b>			
Number of patents/copyrights/trademarks filed or pending (n=7)	7	0	0
Number of licensed technologies developed (n=2)	2	0	0
Number of start-up/spin-out companies established (n=2)	2	0	0
Number of industrial collaborations established (n=46)	42	4	0
Number of commercialisation outputs per €1 million spend	0.7	0.1	0.0

## Appendix C Summary of key indicators from awards ending 2018–19, by broad research area

Table 13: Summary of key payback indicators from awards ending in 2018–19, per broad research area

Impact category/key indicator (no.)	Applied Biomedical Research (n=40.0 awards)	Clinical Research (n=56.0 awards)	Health Services Research (n=52.5 awards)	Population Health Sciences (n=21.5 awards)
<b>Amount invested (€)</b>	<b>€11,529,224</b>	<b>€13,020,262</b>	<b>€19,940,672</b>	<b>€4,993,110</b>
<b>1. Knowledge creation</b>				
Total number of peer-reviewed publications (n=792)	124.5	182.5	409.0	76.0
Mean number of peer-reviewed publications per award	3.1	3.3	7.8	3.5
Average number of publications per €1 million spend	10.8	14.0	20.6	15.2
Number of scientific presentations (n=1560)	365.5	378.5	608.0	208.0
Number of keynote presentations internationally (n=20)	4.5	8.0	5.5	2.0
<b>2. Capacity building and leadership</b>				
Total number of research-related posts created (n=451)	81	127	202	41
Number of PhD degrees (n=103)	14.5	24.5	59.5	4.5
Number of postdoctoral researchers supported (n=136)	38.5	42.5	42.0	13.0
Number of researchers from a health professional background (n=176)	11	72	74	19
Number of researchers remaining in the national health or research system (n=339)	57.5	99.0	151.0	31.5
Number of awards reporting indicators of peer recognition (n=324)	100.5	93.0	104.0	26.5
Number of research collaborations established (n=396)	87	108	160	41
Number of collaborations with health bodies (n=35)	13.5	5.0	16.0	0.5
Number of new research methods, materials, datasets, or tools developed (n=116)	47	32	31	6
Number of leveraged additional awards (n=174)	55.0	53.5	44.5	21.0
Value of funding leveraged by HRB researchers (total=€100.4 million)	€44,320,003	€42,908,701	€6,342,550	€6,825,689
<b>3. Informing policy, practice, and the public</b>				
Total number of policy/practice outputs (n=190)	16.5	42.0	107.0	24.5
Average number of policy and practice outputs per €1 million spend	1.4	3.2	5.3	5.4
Number of advisory roles to government or policy-makers (n=16)	1.5	7.0	3.0	4.5
Number of policy briefings, practical handbooks, etc. disseminated to research users (policy-makers, health professionals, etc.) (n=9)	0.0	0.5	7.5	1.0

**Outputs, outcomes, and emerging impacts: Results of HRB awards that completed in 2018 and 2019**

Impact category/key indicator (no.)	Applied Biomedical Research (n=40.0 awards)	Clinical Research (n=56.0 awards)	Health Services Research (n=52.5 awards)	Population Health Sciences (n=21.5 awards)
<b>Amount invested (€)</b>	<b>€11,529,224</b>	<b>€13,020,262</b>	<b>€19,940,672</b>	<b>€4,993,110</b>
Number of contributions to clinical treatment or best practice guidelines (n=14)	1.5	7.0	4.5	1.0
Number of policy/health system/public engagement outputs (n=473)	108.5	153.5	145.0	66.0
Average number of policy/health system/public engagement outputs per €1 million spend	9.4	11.8	7.3	13.2
Number of public and patient involvement (PPI) outputs (n=575)	63.5	212.0	222.0	77.5
<b>4. Healthcare innovations</b>				
Total number of healthcare innovations developed (n=57)	9.5	20.5	24.0	3.0
Number of therapeutic interventions (behavioural, drug, cell, vaccine) (n=10)	5.0	2.5	2.5	0.0
Number of preventative interventions ((behavioural) (n=3)	0	0	3	0
Number of prognostic or diagnostic tools (n=11)	3.0	6.0	1.5	0.5
Number of care models and clinical decision support tools (n=12)	0.5	6.5	5	0
Number of innovations in the design/pilot/feasibility/proof-of-concept/trial stages (n=34)	9.0	11.5	11.0	2.5
Number of innovations adopted in the health system (small or large scale) (n=22)	0.5	9.0	12.0	0.5
Average number of healthcare innovations per €1 million spend	0.8	1.6	1.2	0.6
<b>5. Commercialisation and economic benefits</b>				
Number of patents/copyrights/trademarks filed or pending (n=7)	1.5	3.0	2.0	0.5
Number of licensed technologies developed (n=2)	1.0	0.5	0.5	0.0
Number of start-up/spin-out companies established (n=2)	0	1	1	0
Number of industrial collaborations established (n=46)	20	15	8	3
Number of commercialisation outputs per €1 million spend	0.7	0.7	0.2	0.1

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